

# Annotating the Focus of Negation in terms of Questions Under Discussion

**Pranav Anand**

Department of Linguistics  
University of California, Santa Cruz  
Santa Cruz, CA 95064 USA  
panand@ucsc.edu

**Craig Martell**

Department of Computer Science  
Naval Postgraduate School  
Monterey, CA USA  
cmartell@nps.edu

## Abstract

Blanco & Moldovan (Blanco and Moldovan, 2011) have empirically demonstrated that negated sentences often convey implicit positive inferences, or focus, and that these inferences are both human annotatable and machine learnable. Concentrating on their annotation process, this paper argues that the focus-based implicit positivity should be separated from concepts of scalar implicature and neg-raising, as well as the placement of stress. We show that a model making these distinctions clear and which incorporates the pragmatic notion of question under discussion yields  $\kappa$  rates above .80, but that it substantially deflates the rates of focus of negation in text.

## 1 Introduction

The recent paper by Blanco & Moldovan (Blanco and Moldovan, 2011) has highlighted the fact that negation in natural language is more than just a propositional logic operator. The central claims of the paper are that negation conveys implicit positivity more than half of the time and that such positivity is both reliably annotatable by humans and promisingly learnable by machine. In this paper, we evaluate their annotation process and propose a different model that incorporates the pragmatic concept that discourse is guided by *questions under discussion* (QUDs), often implicit issues that hearers and speakers are attending to. We concentrate on the corpus used in (Blanco and Moldovan, 2011), PB-FOC.<sup>1</sup>

<sup>1</sup>PB-FOC was released as part of \*SEM 2012 Shared Task: Resolving the Scope and Focus of Nega-

Our animating concern can be seen concretely by comparing the examples<sup>2</sup> from the corpus provided below.

- (1) a. “They were willing to mistreat us because we hadn’t shown **any moxie, any resistance**,” says William Queenan, a DC-10 pilot and 14-year Federal veteran. (ex. 939)
- b. “**I** won’t be throwing *90 mph*, but I will throw 80-plus,” he says. (ex. 1)
- c. “**Some shows** just don’t impress, he says, and this is one of them.” (ex. 30)
- d. “But we don’t believe **there is enough of a difference to be clinically significant**,” Dr. Sobel said. (ex. 426)

We believe these examples are incorrectly annotated, but in somewhat different ways. Following Blanco & Moldovan, assume that focus of negation is diagnosed by an implication that some alternative to the focus would make a sentence true. Then in (1a), in which the focus is annotated as being on the negative polarity item *any moxie, any resistance*, it is not clear that there is focus at all. If there were, the sentence would imply that the pilots in question showed something but not some moxie. This doesn’t seem to be the meaning intended. In contrast, in (1b), we agree that focus is present, but take it to be on the phrase *90 mph*, as is confirmed

<sup>2</sup><http://www.clips.ua.ac.be/sem2012-st-neg/>

<sup>2</sup>The citation (ex. *n*) will refer to the *n*th annotated instance in the PB-FOC dataset. In these and following examples, we indicate the PB-FOC focus by emboldening and our suggested alternative (if present) by italics

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by the overt contrast that follows. Finally, (1c) and (1d) both show something more complex; in (1c) the scalar quantifier *some* is not in the scope of negation (lest it mean no shows impress), and thus cannot be a focus. Nonetheless, we agree that a positive implicature arises here (namely, that some shows do impress), but we suggest that this is simply a fact about scalar implicatures. Finally, in (1d), in which the verb *believe* is a so-called neg-raiser (a predicate  $P$  such that  $\neg P(x) \leftrightarrow P(\neg x)$ ), the implicit positivity about a belief the doctors have is not due to pragmatic focus, but a lexical property of the verb in question.

In sum, what worried us was the variety of constructions being considered equivalent. In order to respond to these concerns, we reannotated 2304 sentences from the development subcorpus, being careful to try to tease apart the relevant distinctions mentioned above. This paper documents that effort. Our central finding is that the PB-FOC data contains an overabundance of focus-marked phrases (i.e., cases like (1a)): the PB-FOC rate of focus marking in our subcorpus is 74% (somewhat higher than the 65% for the whole dataset), while we observed a rate of 50%. Although the reduction in focus-marking occurs across all Propbank role types, we show that it is highest with the A1 and AM-MNR roles. One central reason for the overmarking, we argue, is that the definition of focus of negation Blanco & Moldovan use is somewhat vague, allowing one to confuse emphasis with implicit positivity. We argue instead that although they are right to correlate stress with focus (by and large), focus is connected to referencing a QUD (Rooth, 1996; Roberts, 1996; Kadmon, 2001), and only indirectly leads to positivity.

## 2 Delimiting Focus of Negation

### 2.1 What Focus of Negation is

Following (Huddleston and Pullman, 2002), Blanco & Moldovan define the focus of negation as “that part of the scope [of negation] that is most prominently or explicitly negated.” They further argue that when there is a focus of negation, it yields a corresponding positive inference. This idea has roots in Jackendoff’s seminal theory of focus (Jackendoff, 1972). Jackendoff proposes a) that focus in general

(with or without negation) partitions a sentence into a function, obtained by lambda abstracting over the focused constituent and b) that negation is a focus-sensitive operator, stating that the function applied to the focused constituent yields falsity. To capture the positive inference cases, Jackendoff initially claims that focus always presupposes that there is some element in the function’s domain (i.e., there is some way to make the sentence true).

(2) Bill likes **Mary**.  $\mapsto \langle \lambda x \text{ Bill likes } x, \text{Mary} \rangle$

(3)  $\text{not}(\langle f, x \rangle) = 0$ .

(4) focus presupposition:  $\exists y[f(y) = 1]$ .

While 4 might be correct for focus-sensitive operators like *only*, it is clearly not for negation. As Jackendoff himself points out, the sentence

(5) Bill doesn’t like **anybody**.

clearly does not lead to the inference that Bill likes someone, even when *anybody* is strongly stressed. More contemporary work (Rooth, 1996; Roberts, 1996) has instead argued that what focus presupposes is that there is a relevant question under discussion (QUD). In the case of 2, it is the question

(6) Who does Bill like?

The QUD model assumes that dialogue is structured in terms of currently relevant (often implicit) questions, which serve to explain how a coherent discourse arises. Focus is thus coherent in context if the corresponding QUD is relevant. This serves to explain Jackendoff’s counterexample (5) – *anybody* is focused because the question (6) is currently relevant. Under this account, focus of negation does not automatically yield an existential positive inference, but only if the corresponding QUD is assumed to exclude negative answers (i.e., if it is assumed that *no one* is not a suitable answer to *Who does Bill like?*). Adopting the QUD model thus means that in determining the positive inferences from a negated sentence, we must ask two questions:

- a) What is the relevant QUD for this sentence/sub-sentence?
- b) Does that QUD in context prohibit negative answers?

## 2.2 What isn't Focus of Negation

Thus, we see that the positive inference resulting from a negated sentence is the result of an interplay of the general meaning of focus (referencing a relevant QUD) and context (furnishing an assumption that some non-negative answer to the QUD exists). However, there is another way of yielding positive inferences to negated sentences, relying merely on the familiar theory of scalar implicature. Consider (7) below, which involves the scalar expression *much* (roughly equivalent to *a lot*). In positive assertions, using the quantifier *a lot* entails the corresponding alternative with *some*, and using *all* entails *a lot*. In the scope of negation, these patterns reverse, giving rise to opposite implicatures. Thus, (7) implicates that the stronger alternative (8) is false and thus (9) – that *some but not much* of a clue is given.

- (7) assertion: However, it doesn't give much of a clue as to whether a recession is on the horizon. (ex. 122)
- (8) stronger alternative: It doesn't give any clue as to whether a recession is on the horizon.
- (9) implicature: It gives some clue as to whether the recession is on the horizon.

A different problem occurs with 'neg-raising' predicates like *believe*, *expect*, *think*, *seem*, and *want*. Since (Filmore, 1963), it has been noted that some clausal embedding predicates seem to interpret a superordinate negation inside their scope – that is, *BILL DOESN'T THINK MARY IS HERE* seems to be equivalent to *BILL THINKS MARY ISN'T HERE*.

While neg-raising is defeasible in certain contexts and its explanation is contentious (see (Gajewski, 2007) for discussion), it does not seem to be dependent on focus *per se*. In particular, putting focus on any element in the complement clause seems to engender a different positive inference. For example, in (10), this would give rise to the inference that Bill wants to talk to someone else, not simply that he wants to not talk to Mary.

- (10) Bill doesn't want to talk to **Mary**.

In short, neg-raising cases should be considered more properly to be cases where the *scope* of negation is semantically lower than it appears, not cases of focus driven inference.

## 3 Reannotation

We annotated 2304 examples from the shared task training corpus. As in the original study, annotators were shown a target sentence as well as the prior and following sentence and were asked to mark the focus of negation in the target. Annotators followed a three step process. First, they were instructed to "move" the negation around the sentence to various constituents, as exemplified below, introducing an existential quantificational *some... but not*.

- (11) a. [She]<sub>A0</sub> didn't have [hot water]<sub>A1</sub> [**for five days**]<sub>AM-TMP</sub>. (ex. 1925)
- b. Someone but not her had hot water for five days.
- c. She had something but not hot water for five days.
- d. She had hot water but not for five days.

They were then asked to determine which if any of these was most relevant, given the surrounding context and mark that as the focus. In determining which was most relevant, annotators asked whether the question corresponding to each altered sentence (e.g., Who had hot water for five days?) appeared to be under discussion in context.<sup>3</sup>

Three linguist annotators were selected and trained on 20 examples randomly drawn from the training set, including 5 examples of scalar "focus", 3 of neg-raising, and 5 instances of no focus. Annotators were given explicit feedback on each trial annotated. The annotators then annotated the remaining 2284 examples in our subcorpus with 100% overlap and 2 annotators per token.

### 3.1 Results

Figure 1 summarizes the differences between PB-FOC and our annotation by role<sup>4</sup>. Our annotators achieved a pairwise  $\kappa$  of 0.82. Our agreement with PB-FOC was significantly lower:  $\kappa = 0.48$  if we exclude scalars and neg-raisers and 0.59 if we count them as focused.

<sup>3</sup>The QUD model in general allows multiple foci, e.g., Who had hot water when? We did not consider multiple foci in the present study.

<sup>4</sup>Other consists of C-A1, AM-PNC, AM-LOC, A4, R-A1, AM-EXT, A3, R-A0, AM-DIR, AM-DIS, R-AM-LOC

PB-FOC ROLE	COUNT	AGREED	SCALAR	NEG-RAISING	NO FOCUS	OTHER
A1	920	332	54	101	372	61
NO FOCUS	591	532	0	0	AGREED	59
AM-TMP	160	116	0	0	29	15
AM-MNR	125	51	28	0	40	6
A2	112	43	1	0	47	21
A0	88	24	20	0	23	21
AM-ADV	77	30	3	0	26	18
No Role	69	42	2	0	19	6
Other	161	42	8	20	75	16
TOTAL	2303	1212	116	121	631	223

Figure 1: Overall comparison of roles

As Figure 1 shows, the central reason for this discrepancy is the 631 examples where our annotators did not find focus where PB-FOC indicated that there was some; in contrast, only 59 examples that PB-FOC labeled as focusless were disagreed with. There are two interesting trends. First, we found an abundance of cases where the the question produced by the PB-FOC focus yielded an uninformative question (12% of disagreements), often in cases containing predicates of possession (e.g., *have*, *contain*). For example, in (12), the PB-FOC label would be answer the question *What do American Brands conclude they have under the contract?*, which does not seem relevant in context.

- (12) possession (7%): “We have previously had discussions with representatives of Pinkerton’s Inc. concerning the (sale of the company) and we concluded that we did not have **liability** under the contract,” says American Brands. (ex. 181)

An additional 4% of the disagreements involved idiomatic expressions, where neither the syntactic nor the semantic sub-constituents could be meaningfully separated; in (13), *take kindly to that* as a whole is negated, and focusing on any one part will upset the idiom. Although of small number, the biased questions exemplified in (14) are illustrative of negation’s chimerical lives; in these questions, negation’s function is at the discourse level and it has no propositional negative force.

- (13) idioms (4%): But media-stock analyst Richard J. MacDonald of MacDonald

Grippo Riely says Wall Street won’t take **kindly** to that. (ex. 2081)

- (14) biased questions (10 instances): But wouldn’t a president who acted despite Senate objections be taking **grave political risks**? (ex. 489)

## 4 Conclusion

We have argued that while the study of the focus of negation is of compelling interest to the computational community, more work is needed at theory- and annotation-building levels before we can effectively ask machine learning questions. We have suggested that one promising route for pursuing this is to operationalize the question under discussion model of focus’s contribution to a sentence, and that such a procedure yields a marked decrease in the prevalence of focus of negation in PB-FOC. This partly follows from our decision on linguistic grounds to separate focus of negation from scalar implicature and neg-raising. From an engineering perspective, if our goal is to extract any positive inference from negated clauses, such distinctions may be academic. We suspect, however, that the linguistic heterogeneity substantially complicates annotator’s task. We have shown that by explicitly telling annotators what the differences are, agreement rises, and we think future work should incorporate such a model. Finally, we plan on annotating foci that do not yield positive inferences, since it has the hope of giving us a window into when and how focus gives rise to positivity.

## References

- Eduardo Blanco and Dan Moldovan. 2011. Semantic Representation of Negation Using Focus Detection. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL-HLT 2011)*, Portland, OR, USA.
- Charles Fillmore. 1963. The position of embedding transformations in grammar. *Word*, 19:208–231.
- Jan Robert Gajewski. 2007. Neg-raising and polarity. *Linguistics and Philosophy*, 30:289–328.
- Rodney Huddleston and Geoffrey K. Pullman. 2002. *The Cambridge Grammar of the English Language*. Cambridge University Press.
- Ray Jackendoff. 1972. *Semantic Interpretation in Generative Grammar*. MIT Press, Cambridge, Mass.
- Nirit Kadmon. 2001. *Formal Pragmatics: Semantics, Pragmatics, Presupposition, and Focus*. Wiley-Blackwell.
- Craig Roberts. 1996. Information structure: Towards an integrated theory of formal pragmatics. In Jae-Hak Yoon and Andreas Kathol, editors, *OSU Working Papers in Linguistics, Volume 49: Papers in Semantics*, pages 91–136. The Ohio State University Department of Linguistics.
- Mats Rooth. 1996. Focus. In Shalom Lappin, editor, *The Handbook of Contemporary Semantic Theory*, pages 271–298. Blackwell, Oxford.